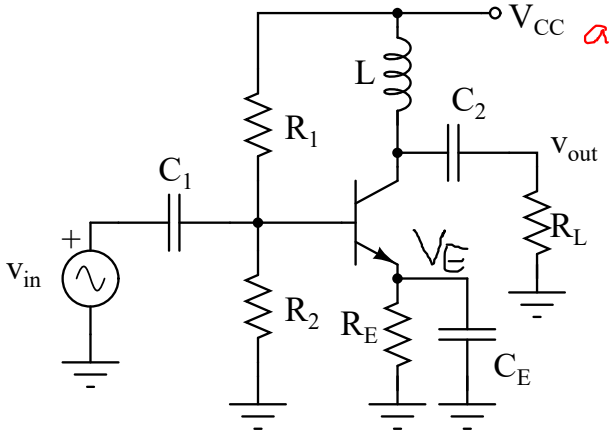
EE313 Quiz #3

(April 17, 2024, 30 minutes, one A4 cheat sheet allowed)

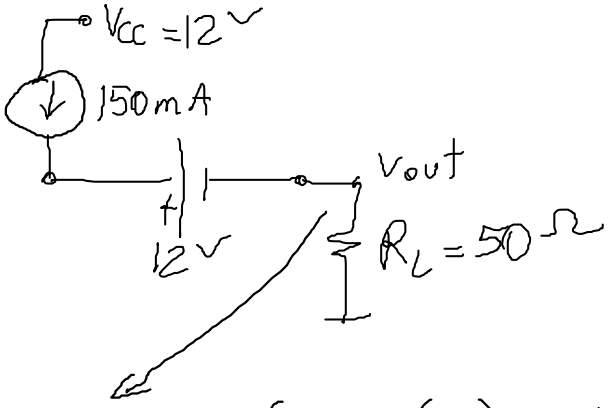
Name		Grade	

Consider the following Class-A power amplifier biased with R_1, R_2, and R_E such that $I_E \approx I_C = 150$ mA under quiescent conditions. C_1, C_2, and C_E are so large that they can be assumed to be short circuits at AC. L_1 is a large inductance that can be assumed to be an open circuit at AC. With $V_{CC}=12$ V, $R_E=10\ \Omega$, $R_L=50\ \Omega$, and $V_{sat}=0.3$ V

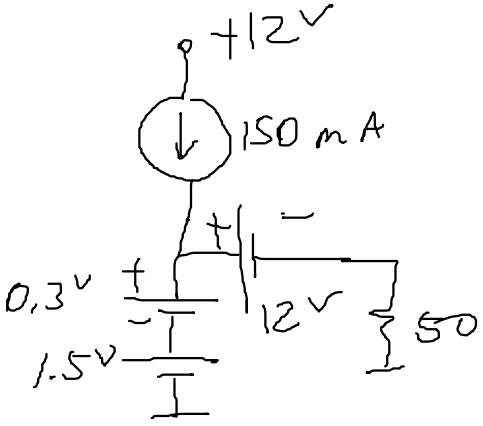
a. Find the maximum undistorted peak-to-peak amplitude of the output voltage, v_{out}.
b. Find the efficiency of the amplifier for the 10V peak-to-peak output voltage. Ignore the current through R_1.



a)



$V_{outmax} = (0.15)(50) = 7.5\ V$



$V_E = R_E I_C = (10)(0.15) = 1.5\ V$

$V_{outmin} = 1.5 + 0.3 - 12 = -10.2\ V$

$\Rightarrow V_{pp\,max} = 2 \times 7.5 = \boxed{15\ V\ pp}$

b) $V_{pp} = 10\ V$ $P_{out} = \left(\frac{(V_{pp}/2)}{\sqrt{2}}\right)^2 \frac{1}{R_L} = \left(\frac{5}{\sqrt{2}}\right)^2 \frac{1}{50} = 0.25\ W$

$P_S = 12 \times 0.15 = 1.8\ W$

$\eta = \frac{P_{out}}{P_S} = \frac{0.25}{1.8} = 0.139 = \boxed{13.9\%}$